PATENT ABSTRACTS OF JAPAN

(11)Publication number : **2002-277694**
(43)Date of publication of application : **25.09.2002**

(51)Int.Cl. G02B 6/42
G02B 6/122
G02B 6/13
H01L 31/0232
H01S 5/022
H05K 1/02

(21)Application number : **2001-077815**
(22)Date of filing : **19.03.2001**

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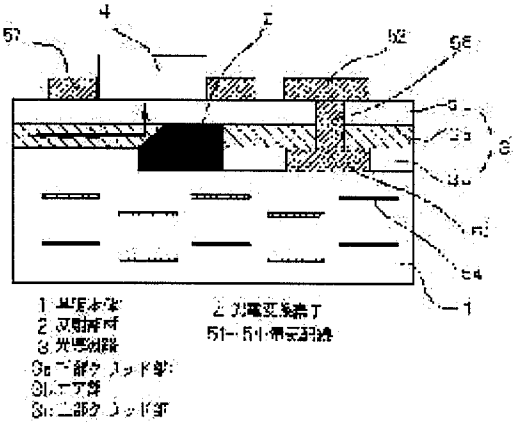
(54) SUBSTRATE HAVING OPTICAL WAVEGUIDE AND ELECTRIC CIRCUIT AND METHOD FOR MANUFACTURING THE SUBSTRATE

(57)Abstract:
PROBLEM TO BE SOLVED: To obtain a substrate having an optical waveguide and an electric circuit and improved in packaging density and the efficiency of light propagation.
SOLUTION: The optical waveguide 3 and a photoelectric transducing element 4 having a light receiving part or a light emitting part on the side of the waveguide 3 are mounted on a substrate body 1 and a reflection member 2 opposed to the core part 3b of the waveguide 3 obliquely to the optical axis of the waveguide 3 and consisting of a lump-like metal optically connects light propagated through the waveguide 3 to the element 4.



LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

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CLAIMS

[Claim(s)]
[Claim 1] A substrate body, the optical waveguide prepared in this substrate body, and the optoelectric transducer which is prepared in this optical waveguide top or the above-mentioned substrate body, and has a light sensing portion or a light-emitting part in an above-mentioned optical waveguide or substrate body side, It is the substrate which has the optical waveguide and the electrical circuit which are characterized by having the reflective member which connects optically the above-mentioned optical waveguide and the above-mentioned optoelectric transducer, and laying the above-mentioned reflective member under the above-mentioned optical waveguide, and for an opposed face with the above-mentioned optical waveguide inclining to the optical axis of optical waveguide, and consisting of a massive metal.
[Claim 2] It is the substrate which optical waveguide consists of the lower clad section, the core section prepared in this lower clad section, and the up clad section prepared in this core section, and has the optical waveguide and the electrical circuit according to claim 1 which are characterized by a reflective member countering with the above-mentioned core section at least.
[Claim 3] The substrate which has the optical waveguide and the electrical circuit according to claim 1 or 2 which are characterized by connecting with the electric wiring which electric wiring was prepared in optical waveguide and prepared in the optical waveguide top or the substrate body electrically.
[Claim 4] The substrate which has optical waveguide and an electrical circuit according to claim 1 to 3 is that by which two or more laminatings were carried out. The 1st reflective member which while has the above-mentioned optical waveguide and an electrical circuit, and was prepared in the substrate, The 1st electric wiring which while has the above-mentioned optical waveguide and an electrical circuit in the optical connection with the 2nd reflective member prepared in the substrate of another side which has the above-mentioned optical waveguide and an electrical circuit, and a list, and was prepared in them at the substrate, The substrate which has the optical waveguide and the electrical circuit by which it is giving [at least one side of electrical installation with the 2nd electric wiring prepared in the substrate of another side which has the above-mentioned optical waveguide and an electrical circuit] characterized.
[Claim 5] Consist of the lower clad section, the core section prepared in this lower clad section, and the up clad section prepared in this core section, and even if there is little optical waveguide prepared in the substrate body, the above-mentioned core section is countered. It is the manufacture approach of a substrate of having the optical waveguide and the electrical circuit according to claim 2 to 4 under which a reflective member is laid. The manufacture approach of a substrate of having the optical waveguide and the electrical circuit which give the process which prepares the reflective member which consists of a massive metal equipped with the field which inclines to the optical axis of the above-mentioned optical waveguide on the above-mentioned substrate body, and the process which prepares optical waveguide so that the above-mentioned reflective member may be laid under the list.
[Claim 6] The manufacture approach of a substrate of having the optical waveguide and the electrical circuit according to claim 5 which are characterized by giving the process which prepares the lower clad

section of optical waveguide beforehand on a substrate body before the process which prepares a reflective member in a substrate body.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the substrate (it abbreviates to optical-electrical circuit substrate hereafter) which has optical waveguide and an electrical circuit, and its manufacture approach. In addition, optical-electrical circuit substrate means the circuit board having both the optical waveguide which spreads a lightwave signal, and the electrical circuit which performs transmission of an electrical signal.
[0002]
[Description of the Prior Art] Towards development of the super parallel computer which carries out juxtaposition signal processing of the optical transmission system of high-speed large capacity, or much interprocessors, it is high-density and development of the optical interconnection which communicates the inside of equipment is performed in influence. In case such optical INTAKONEKUSHON is performed, since an electron device bears processing of the spread lightwave signal, a bubble ********-electrical-and-electric-equipment hybrid system is needed for the boundary device which connects them for the electrical circuit for making optical waveguide, an optoelectric transducer, LSI for electronics control and a switch, or electronic parts drive. It is Vertical in order to realize communication system [broadband at high speed] especially. Cavity Surface Emitting Laser (VCSEL), Laser The demand of optical-electrical circuit substrate which can mount an optoelectric transducer like Diode (LD) and a photodiode (PD) is increasing.
[0003] the sectional view showing the lightwave signal propagation structure of a system drawing 9 was indicated to be by the provisional-publication-of-a-patent No. 47044 [2000 to] official report -- it is -- the inside of drawing, and 60 -- a photo detector and 61 -- for a core and 64, as for an incidence side reflector and 66, a mirror and 65 are [a substrate and 62 / a clad and 63 / an outgoing radiation side reflector and 67] light emitting devices. By namely, the mirror 64 prepared in the optical waveguide which consists of the clad 62 and core 63 on a substrate 61 It is the lightwave signal propagation system which a photo detector 60 is made to receive by bending the travelling direction of the light from a light emitting device 67. A mirror 64 is the thing which the end face was made to counter with the predetermined include angle theta to the end face of a core 63, using a different ingredient also from a clad 62 and a core 63. For example, polymeric materials, such as inorganic materials, such as a quartz, an epoxy system, and acrylic ultraviolet-rays hardening resin, polyimide, can be used.
[0004] moreover, in a publication-number No. 183761 [11 to] official report It is mounted on the above-mentioned substrate with the optical waveguide which consists of the clad section prepared in the substrate, and the core section. The optoelectric transducer which has a light sensing portion or a light-emitting part on the inferior surface of tongue with the optical connection structure optically connected through the mirror plane which counters in the lower part of the above-mentioned optoelectric transducer while countering the end face of the above-mentioned optical waveguide It is filled up with the resin which has the almost same refractive index as the above-mentioned core section between the end face of the above-mentioned optical waveguide, and the above-mentioned mirror plane. For

example, the above-mentioned mirror plane is formed by forming a predetermined slant face in the layer by which the laminating was carried out like the clad section to the top face of a substrate, and putting a metal on it by vacuum evaporationo, a spatter, etc. on the slant face.
[0005]
[Problem(s) to be Solved by the Invention] However, the thing indicated by the provisional-publication-of-a-patent No. 47044 [2000 to] official report since inorganic materials, such as a quartz, are used as a mirror, it is easy to be divided with stress -- moreover, since polymeric materials, such as an epoxy system, and acrylic ultraviolet-rays hardening resin, polyimide, are used The technical problem that the propagation property of light was not stabilized since it is that coefficient of linear expansion is large occurred, and in order for the above-mentioned mirror to pass a part of light further, the technical problem that reflective effectiveness was bad and the propagation effectiveness of light was bad occurred. Moreover, the mirror plane made the metal put, and since metal thickness was thin, some which were indicated by the publication-number No. 183761 [11 to] official report had the technical problem that reflective effectiveness was bad and the propagation effectiveness of light was bad, in order for a mirror to pass a part of light.
[0006] It aims at acquiring the manufacture approach of the substrate which has the optical waveguide which this invention was made in order to cancel this technical problem, packaging density and its propagation effectiveness of light improve, and has the stable propagation property, and an electrical circuit, and the substrate which has optical waveguide and an electrical circuit with sufficient manufacture effectiveness in a list.
[0007]
[Means for Solving the Problem] The substrate which has the 1st optical waveguide and electrical circuit concerning this invention A substrate body, the optical waveguide prepared in this substrate body, and the optoelectric transducer which is prepared in this optical waveguide top or the above-mentioned substrate body, and has a light sensing portion or a light-emitting part in an above-mentioned optical waveguide or substrate body side, It has the reflective member which connects optically the above-mentioned optical waveguide and the above-mentioned optoelectric transducer, and the above-mentioned reflective member is laid under the above-mentioned optical waveguide, and an opposed face with the above-mentioned optical waveguide inclines to the optical axis of optical waveguide, and it consists of a massive metal.
[0008] Consisting of the core section which optical waveguide prepared in the lower clad section and this lower clad section in the substrate with which the substrate which has the 2nd optical waveguide and electrical circuit concerning this invention has the 1st optical waveguide of the above, and an electrical circuit, and the up clad section prepared in this core section, a reflective member counters with the above-mentioned core section at least.
[0009] The substrate which has the 3rd optical waveguide and electrical circuit concerning this invention is electrically connected with the electric wiring which electric wiring was prepared in optical waveguide and prepared in the optical waveguide top or the substrate body in the substrate which has the 1st or 2nd optical waveguide of the above, and an electrical circuit.
[0010] The substrate which has the 4th optical waveguide and electrical circuit concerning this invention The substrate which has the above 1st thru/or the 3rd one of optical waveguides and electrical circuits is that by which two or more laminatings were carried out. The 1st reflective member which while has the above-mentioned optical waveguide and an electrical circuit, and was prepared in the substrate, The 1st electric wiring which while has the above-mentioned optical waveguide and an electrical circuit in the optical connection with the 2nd reflective member prepared in the substrate of another side which has the above-mentioned optical waveguide and an electrical circuit, and a list, and was prepared in them at the substrate, At least one side of electrical installation with the 2nd electric wiring prepared in the substrate of another side which has the above-mentioned optical waveguide and an electrical circuit is given.
[0011] The manufacture approach of a substrate of having the 1st optical waveguide and electrical circuit concerning this invention Consist of the lower clad section, the core section prepared in this

lower clad section, and the up clad section prepared in this core section, and even if there is little optical waveguide prepared in the substrate body, the above-mentioned core section is countered. It is the manufacture approach of a substrate of having the above 2nd under which a reflective member is laid thru/or the 4th one of optical waveguides and electrical circuits. It is the approach of giving the process which prepares the reflective member which consists of a massive metal equipped with the field which inclines to the optical axis of the above-mentioned optical waveguide on the above-mentioned substrate body, and the process which prepares optical waveguide so that the above-mentioned reflective member may be laid under the list.

[0012] The manufacture approach of a substrate of having the 2nd optical waveguide and electrical circuit concerning this invention is an approach of giving the process which prepares the lower clad section of optical waveguide beforehand on a substrate body before the process which prepares a reflective member in a substrate body, in the manufacture approach of a substrate of having the 1st optical waveguide of the above, and an electrical circuit.

[0013]

[Embodiment of the Invention] Gestalt 1. drawing 1 of operation is a sectional view explaining optical-electrical circuit substrate of the gestalt of operation of the 1st of this invention, and is a substrate having both the optical waveguide which spreads a lightwave signal, and the electrical circuit which performs transmission of an electrical signal. In addition, one is a substrate body among drawing, drawing is an electrical circuit substrate which has electric wiring, and, as for the optical waveguide which a reflective member and 3 become from lower clad section 3a, core section 3b, and up clad section 3c in 2, and 4, an optoelectric transducer, and 51-54 are electric wiring.

[0014] That is, as shown in drawing 1 , the optoelectric transducer 4 which has a light sensing portion or a light-emitting part in this optical waveguide 3 and optical waveguide 3 side at the substrate body 1 is formed, and optical - electrical circuit substrate of the gestalt of this operation can connect optically to the above-mentioned optoelectric transducer 4 the light which spread the above-mentioned optical waveguide 3 by the reflective member 2 laid underground at the above-mentioned optical waveguide 3.

[0015] The reflective member 2 concerning the gestalt of operation of this invention consists of a massive metal, it is for connecting the lightwave signal which has spread optical waveguide 3 optically [it is efficient and] to an optoelectric transducer, and when an opposed face with optical waveguide 3 inclines to the optical axis of optical waveguide 3 and has about 45-degree inclination, it has the operation which bends about 90 degrees of optical paths. However, the above-mentioned opposed face does not have whenever [tilt-angle] adjusted, and is not limited to whenever [above-mentioned tilt-angle] so that it can connect optically efficiently. Moreover, drawing 2 (a) - (c) is the sectional view showing the field where the reflective member 2 and optical waveguide counter in optical - electrical circuit substrate of the gestalt of this operation. That is, although the reflective member 2 is produced in drawing 1 from the top face of the substrate body 1 to the top face of core section 3b, if the reflective member 2 is produced so that core section 3b may be countered at least as shown in drawing 2 , it can attain the expected purpose.

[0016] Moreover, as a reflective member 2, metals, such as Au, Ag, Cu, nickel, Pd, Pt, Zn, Co, Fe, Mn, Cr, aluminum, Sn, Pb, In, Bi, and Ti, or the alloy of those can be used. Since it is a metal with the massive reflective member 2, or its alloy, while the light which spread optical waveguide can be reflected efficiently and the propagation effectiveness of light improves, the reflective member 2 can be used as a part of electric wiring which constitutes an electrical circuit, and packaging density improves.

[0017] As shown in drawing 1 , the optical waveguide 3 concerning the gestalt of operation of this invention consists of lower clad section 3a, core section 3b prepared in this lower clad section, and up clad section 3c prepared in this core section, and spreads a lightwave signal in the direction parallel to the substrate body 1 through core section 3b with a larger refractive index than the refractive index of the clad sections 3a and 3c. In addition, at drawing 1 , it cannot be overemphasized that it spreads while the light which carried out incidence of the inside of core section 3b within the limits of the predetermined critical angle in practice although it was drawn so that light might go straight on repeats total reflection by the interface with core section 3b, up clad section 3a, and lower clad section 3c.

Moreover, the ingredient used for optical waveguide 3 is compound semiconductors, such as inorganic polymers, such as organic macromolecules, such as ceramics, such as SiO2, TiO2, or aluminum 2O3, polyimide resin, acrylic resin, an epoxy resin or polycarbonate resin, and benz-cyclo-butene resin, and silicone resin, GaAs, GaP and InP, InAs, ZnO and ZnS, or CdS, or those derivatives, a copolymer, or a mixture, and may use what fluorinated, deuterated or halogenated the functional group of said ingredient with the propagation wavelength of a lightwave signal. Moreover, the mode of the light which spreads the inside of optical waveguide may be a single mode, or may be a multimode.

[0018] The optoelectric transducer concerning the gestalt of operation of this invention has the operation which changes lightwave signals, such as VCSEL (VerticalCavity Surface Emitting Laser), and LD (Laser Diode) or PD (Photo Diode), into an electrical signal. The above-mentioned optoelectric transducer Moreover, Au, Ag, Cu, nickel, Pd, Pt, The metal bump connection using metals, such as Zn, Co, Fe, Mn, Cr, aluminum, Sn, Pb, In, Bi, and Ti, or the alloy of those, Junction by the conductive binder which mixed in resin the conductive particle which consists of the above-mentioned metal or its alloy, Or SnO2, ZnO, In2O3, CdO, CdIn 2O4, Zn2SnO4, TiO2, ZrN, It connects with the electric wiring 52 in drawing 1 electrically by metal wire junction of junction by the conductive resin which mixed in resin the particle of the conductor which are not metals, such as TiN or C, and the conductor which is not the above-mentioned metal, Au, aluminum, etc., etc.

[0019] The substrate body concerning the gestalt of operation of this invention consists of an insulating material. An insulating material An epoxy resin, Phenol resin, Teflon (trademark), polyphenylene ether, Organic resin, such as BT resin (copolymer of bismaleimide and triazine), Compound semiconductors, such as simple substances, such as glass, and Si, germanium, or GaAs, GaP and InP, InAs, and ZnO, ZnS, CdS, are used. [ceramics, such as SiO2 B-2s aluminum / O3 BaO, LiO2, MgO CaO, and / 2O3, and AlN BN, SiN and] moreover, the above-mentioned insulating material connotes textile fabrics and the nonwoven fabric by glass, inorganic fiber like carbon, and organic fiber like aramid, or a metallic oxide (it ZnO(s) SiO2, B-2s aluminum [O3 and] 2O3, and TiO2 and LiO2 --) CaO, MgO, FeO, SnO, Sb 2O3, a metal nitride (it BN(s)) AlN, a metal hydroxide (CaOH, MgOH, aluminum3 (OH)), A metal organic-acid salt (CaSiO3, MgCO3, ZnCO3, BaCO3, CaSO4, BaSO4), Particles, such as a metal inorganic-acid salt (CaSiO3, CaTiO3, MoS, Zn (BO3)2) or an organic quantity molecular-weight object (polystyrene, the poly acrylic, polyphenol, polybutadiene), may be contained.

[0020] In addition, although the substrate of the above-mentioned insulating material is used especially for the above-mentioned substrate body when it does not need electric wiring, the electrical circuit substrate with which electric wiring was prepared is sufficient as it. The electric wiring of an electrical circuit substrate has the one side plate which produced electric wiring only on one side, and the double-sided plate which produced electric wiring to both sides. Furthermore, you may be the multilayer board which has the layer of the electric wiring of three or more layers isolated by the above-mentioned insulating material.

[0021] The electric wiring prepared in the above-mentioned substrate body 1 or the above-mentioned optical waveguide 3 Au, Ag, Cu, nickel, Pd, Pt, Zn, Co, Fe, Mn, Cr, A metal or its alloys, such as aluminum, Sn, Pb, In, Bi, and Ti, The conductive resin which mixed in resin the conductive particle which consists of the above-mentioned metal or its alloy, It is produced using the conductive resin which mixed in resin the particle of the conductor which is not the conductor or the above-mentioned metal which is not metals, such as SnO2, ZnO, In2O3, CdO, CdIn 2O4, Zn2SnO4, and TiO2, ZrN, TiN, C.

[0022] In addition, in the electrical circuit substrate of the above-mentioned double-sided plate or a multilayer board, electric wiring may be mutually connected electrically by the hole and through hole plating which were reinforced. Here with the hole by which reinforcement was carried out [above-mentioned] Au, Ag, Cu, nickel, Pd, Pt, A metal or its alloys, such as Zn, Co, Fe, Mn, Cr, aluminum, Sn, Pb, In, Bi, and Ti, The conductive resin which mixed in resin the conductive particle which consists of the above-mentioned metal or its alloy, The thing of the hole currently filled with the conductive resin which mixed in resin the particle of the conductor which are not metals, such as SnO2, ZnO, In2O3, CdO, CdIn 2O4, Zn2SnO4, and TiO2, ZrN, TiN, C, or the conductor which is not the above-mentioned

metal is pointed out. Moreover, the conductor whose above-mentioned through hole plating is not the above-mentioned metal or its alloy, and the above-mentioned metal, Or the wall surface of a hole is covered with the conductive resin which mixed them. The interior may be a cavity. An epoxy resin, phenol resin, Teflon, Organic resin, such as polyphenylene ether and BT resin (copolymer of bismaleimide and triazine), SiO2, B-2s O3, BaO, LiO2, MgO, and CaO, aluminum2O3, AlN, It may be buried using compound semiconductors, such as simple substances, such as glass, and Si, germanium, or GaAs, GaP and InP, InAs, and ZnO, ZnS, CdS. [ceramics, such as BN and SiN, and] An inorganic fiber [like glass and carbon] whose ingredient which furthermore buries through hole plating is, connoting organic fiber like aramid **** -- a metallic oxide (it ZnO(s) SiO2, B-2s aluminum [O3 and] 2O3, and TiO2 and LiO2 --) CaO, MgO, FeO, SnO, Sb 2O3, a metal nitride (it BN(s)) AlN, a metal hydroxide (CaOH, MgOH, aluminum3 (OH)), A metal organic-acid salt (CaSiO3, MgCO3, ZnCO3, BaCO3, CaSO4, BaSO4), Particles, such as a metal inorganic-acid salt (CaSiO3, CaTiO3, MoS, Zn (BO3)2) and an organic quantity molecular-weight object (polystyrene, the poly acrylic, polyphenol, polybutadiene), may be contained.

[0023] Moreover, electric wiring may be prepared in the inferior surface of tongue of the above-mentioned electrical circuit substrate as mentioned above at the predetermined spacing. Au, Ag, Cu, nickel, Pd, Pt, Zn, Co, Fe, Mn, Cr, The metal bump connection which consists of metals, such as aluminum, Sn, Pb, In, Bi, and Ti, or an alloy of those, Junction by the conductive binder which mixed in resin the conductive particle which consists of the above-mentioned metal or its alloy, Or SnO2, ZnO, In2O3, CdO, CdIn 2O4, Zn2SnO4, TiO2, ZrN, You may be the configuration which boils the particle of the conductor which are not metals, such as TiN or C, and the conductor which is not the above-mentioned metal by metal wire junction of junction by the conductive resin mixed in resin, Au, aluminum, etc., etc., and can be electrically connected to other electrical circuit substrates.

[0024] In the gestalt 1 of the gestalt 2. above-mentioned implementation of operation, if the opposed face with the optical waveguide of a reflective member is equipped with the film of an ingredient especially with a high reflection factor as reflective film, the effectiveness of the optical connection between optical waveguide and an optoelectric transducer can be raised more. Moreover, only the thing of desired wavelength can be connected to an optoelectric transducer among the lightwave signals which have spread optical waveguide by using the reflective film which has wavelength selection nature. The ingredient used for the above-mentioned reflective film can use compound semiconductors, such as inorganic polymers, such as organic macromolecules, such as ceramics, such as metal salt compounds, such as a metal with high reflection factors, such as Au, aluminum, Ag, In, Pb, and Ti, or its alloy, and MgF2, and SiO2, TiO2, aluminum 2O3, polyimide resin, acrylic resin, an epoxy resin, polycarbonate resin, and benz-cyclo-butene resin, and silicone resin, or GaAs, GaP and InP, InAs, and ZnO, ZnS, CdS. Furthermore, the derivative, copolymer, or mixture containing at least one of the above-mentioned ingredients can be used, and what fluorinated, deuterated and halogenated the functional group of the above-mentioned ingredient with the propagation wavelength of a lightwave signal may be used. Moreover, monolayer or multilayers is sufficient as the reflective film produced, and membrane formation is performed using approaches, such as a spin coat, a spray coat, a curtain coat, the flame depositing method, CVD (Chemical Vapor Deposition), vacuum evaporationo, and a spatter.

[0025] In the gestalt 1 of the gestalt 3. above-mentioned implementation of operation, as shown in drawing 1 , the electric wiring 52 produced on the electric wiring 51 produced by the top face of the substrate body 1 and optical waveguide 3 can miniaturize optical - electrical circuit substrate of each other by it, if electric wiring 53 connects electrically. Moreover, as drawing 3 is a sectional view explaining the layer which can form electric wiring concerning the gestalt of operation of this invention and it is shown in the drawing Nakaya mark Electric wiring Lower clad section 3a in optical waveguide 3, core section 3b, up clad section 3c, You may produce in any layer on optical waveguide 3 or within the substrate body 1, the electric wiring formed in each class may be connected electrically, and electrical installation of electric wiring is performed like connection of the electric wiring prepared in the above-mentioned electrical circuit substrate. That is, it connects electrically mutually by the hole or through hole plating reinforced as mentioned above.

[0026] The laminating of the optical - electrical circuit substrate of the gestalten 1-3 of the gestalt 4. above-mentioned implementation of operation can be carried out, it can be stuck, and can be set, between each substrate can be efficiently connected also with a lightwave signal and an electrical signal, and it can miniaturize further. Drawing 4 and drawing 5 are the sectional views of optical-electrical circuit substrate by which the two-sheet laminating of the optical-electrical circuit substrate of the gestalt of operation of this invention was carried out, it was stuck, and was set. Optical - electrical circuit substrate with which a through tube is carried out for six among drawing, and the laminating of the lamination section and 101 is being steadily carried out for 7, Optical-electrical circuit substrate of another side, the 1st reflective member by which 102 was prepared in 12 and 15 were respectively prepared in optical-electrical circuit substrate 101, and the 1st electric wiring, 22 and 25 are the 2nd reflective member and 2nd electric wiring which were respectively prepared in optical-electrical circuit substrate 102, and when drawing 4 is stuck using a part of optical waveguide side, drawing 5 is the case where it sticks using the whole surface of an optical waveguide side. In addition, when electrical circuit substrates are stuck, it is the same with producing optical waveguide to vertical both sides of a substrate body. Moreover, in drawing 4 and drawing 5 , optical - electrical circuit substrate which produced optical waveguide to both sides to the above-mentioned lamination section may be put, and you may multilayer further. Moreover, although drawing shows the case where the laminating of the two optical-electrical circuit substrates is carried out, it can carry out the laminating of two or more above-mentioned substrates.

[0027] That is, the 1st reflective member 12 prepared in one optical-electrical circuit substrate 101 as a laminating was shown in drawing 4 and drawing 5 , It carries out so that the 1st electric wiring 15 which the 2nd reflective member 22 prepared in optical-electrical circuit substrate 102 of another side made optical connection, or was prepared in one optical - electrical circuit substrate 101, and the 2nd electric wiring 25 prepared in optical - electrical circuit substrate 102 of another side may be connected electrically. Moreover, as shown in drawing 5 , when using the whole surface of two optical-electrical circuit substrates by which a laminating is carried out, a through tube 6 is formed in the substrate body 1, and the lightwave signal reflected from the reflective member 2 is connected to an optoelectric transducer 4. Air is sufficient as the interior of a through tube, and it may prepare an optical guided wave object in a through tube in order to improve optical connection effectiveness with an optoelectric transducer 4. An optical guided wave object has the structure where the core section with a larger refractive index than the refractive index of the clad section was embedded in the above-mentioned clad section, and points out optical waveguide, an optical fiber, etc. here.

[0028] In order to stick optical-electrical circuit substrate, the top face of the optical waveguide of the above-mentioned substrate is pasted using adhesives with a refractive index equivalent to the core section or the clad section. As the above-mentioned adhesives, inorganic polymers, such as organic macromolecules, such as polyimide resin, acrylic resin, an epoxy resin, polycarbonate resin, and benz-cyclo-butene resin, and silicone resin, or the derivative containing at least one of the above-mentioned resin, a copolymer, and a mixture are used, and what fluorinated, deuterated and halogenated the functional group of said ingredient with the propagation wavelength of a lightwave signal may be used. moreover, the above-mentioned adhesives connote glass, an inorganic fiber like carbon, and organic fiber like aramid, or a metallic oxide (it ZnO(s) SiO2, B-2s aluminum [O3 and] 2O3, and TiO2 and LiO2 --) CaO, MgO, FeO, SnO, Sb 2O3, a metal nitride (it BN(s)) AlN, a metal hydroxide (CaOH, MgOH, aluminum3 (OH)), A metal organic-acid salt (CaSiO3, MgCO3, ZnCO3, BaCO3, CaSO4, BaSO4), Fillers, such as a metal inorganic-acid salt (CaSiO3, CaTiO3, MoS, Zn (BO3)2) and an organic quantity molecular-weight object (polystyrene, the poly acrylic, polyphenol, polybutadiene), may be contained.

[0029] Moreover, connection of the 1st and 2nd electric wiring prepared in optical-electrical circuit substrate by which a laminating is carried out, respectively Au, Ag, Cu, nickel, Pd, Pt, Zn, Co, Fe, Mn, Cr, A metal or its alloys, such as aluminum, Sn, Pb, In, Bi, and Ti, The conductive resin which mixed in resin the conductive particle which consists of the above-mentioned metal or its alloy, The particle of the conductor which are not metals, such as SnO2, ZnO, In2O3, CdO, CdIn 2O4, Zn2SnO4, and TiO2,

ZrN, TiN, C, can be performed using the conductive resin mixed in resin.
[0030] Gestalt 5. drawing 6 [of operation] (a) - (e) is the explanatory view of the manufacture approach of optical-electrical circuit substrate of the gestalt of operation of this invention, and (a) - (d) explains a production process and it explains a reflective member by (e). The inclined plane where a reflective member base and 30 were prepared in the dicing saw, and 20 prepared 31 in the reflective member, and 32 are tilt angles among drawing. First, the base 20 of lower clad section 3a and a reflective member is produced on the substrate body 1 { drawing 6 (a)}. At this time, the reflective member base 20 may use the electric wiring beforehand produced on the substrate body 1, and after it produces lower clad section 3a, it may produce it by approaches, such as plating, a spatter, and vacuum evaporationo. When electric wiring is beforehand produced on the electrical circuit substrate 1, lower clad section 3a is produced using approaches, such as a spin coat, a spray coat, a curtain coat, the flame depositing method, CVD (Chemical Vapor Deposition), vacuum evaporationo, and a spatter. On the other hand, about the lithography which used ultraviolet-rays hardening resin when clad section 3a was produced previously, and resin without photosensitivity, after patternizing lower clad section 3a wet etching, reactive ion etching (RIE), ion beam etching (IBE), or by carrying out die forming, a reflective member base is produced.
[0031] Next, a metal or the reflective member remainder of the alloy is deposited on the upper part of the reflective member base 21 by approaches, such as electrolytic plating, a spatter, or vacuum evaporationo, and a massive reflective member is prepared { drawing 6 (b)}. At this time, lower clad section 3a may be temporarily protected using a resist so that a metal or its alloy may not adhere to the top face of lower clad section 3a, and an excessive metal may be removed by approaches, such as mechanical polishing, CMP (Chemical Mechanical Polishing), reactive ion etching (RIE), ion beam etching (IBE), and wet etching.
[0032] Next, the inclined plane which had a predetermined include angle to the optical axis of optical waveguide 3 with the dicing saw with a predetermined include angle is formed in a reflective member { drawing 6 (c)}. Although the inclined plane { drawing 6 (e)} which has the tilt angle 32 of 45 degrees to the optical axis of optical waveguide 3 with a dicing saw with the include angle of 90 degrees was formed all over drawing, an inclined plane may be formed by mechanical polishing, CMP (Chemical Mechanical Polishing), reactive ion etching (RIE), ion beam etching, or wet etching, and can also adjust a tilt angle to arbitration.
[0033] If it is the reflective member put in order in the same direction as a cutting plane when using the dicing saw as shown in drawing 7 , two or more inclined planes are producible at once, and if approaches, such as mechanical polishing, CMP (Chemical Mechanical Polishing), reactive ion etching (RIE), ion beam etching (IBE), and wet etching, are used, two or more inclined planes are producible on the same substrate at once. In addition, drawing 7 is an approach **** explanatory view which establishes an inclined plane in a reflective member with the dicing saw concerning the gestalt of operation of this invention, and electric wiring and a dotted line of five are cutting planes among drawing.
[0034] Next, core section 3b and up clad section 3c are produced using approaches, such as a spin coat, a spray coat, a curtain coat, the flame depositing method, CVD (Chemical Vapor Deposition), vacuum evaporationo, and a spatter, { drawing 6 (d)}. At this time, core section 3b produces the pattern of arbitration by approaches, such as wet etching, reactive ion etching (RIE), ion beam etching (IBE), and die forming, about the lithography by ultraviolet-rays hardening resin, and resin without photosensitivity. In addition, what is necessary is to just be produced so that the reflective member 2 may counter with core section 3b, as shown in drawing 2 although the reflective member 2 is produced from the top face of the electrical circuit substrate 1 to the top face of core section 3b in drawing 6 .
[0035] Moreover, a series of production approaches shown in drawing 6 are examples of the production approach of optical - electrical circuit substrate which uses a metal or its alloy as a reflective member, and may also include processes, such as mechanical polishing for flattening, CMP (Chemical Mechanical Polishing), reactive ion etching (RIE), ion beam etching (IBE), and wet etching, in each process.

[0036] Moreover, as shown in drawing 8 , in order to raise the optical connection effectiveness of the reflective member 2 and an optoelectric transducer, field 3ca which consists of an ingredient which forms the core section in up clad section 3c may be prepared. Drawing 8 is the sectional view showing the field where a reflective member and optical waveguide counter in the gestalt of operation of this invention, and 3ca is a field which consists of an ingredient which forms the core section in up clad section 3c. As an approach of preparing field 3ca which consists of an ingredient which forms the above-mentioned core section As shown in drawing 8 , up clad section 3c of the reflective member 2 is patternized. The ingredient which forms the core section A spin coat, a spray coat, a curtain coat, The flame depositing method, CVD (Chemical Vapor Deposition), About the resin which carries out a spatter or does not have vacuum evaporationo, the lithography by ultraviolet-rays hardening resin, and photosensitivity in the upper part of the reflective member 2 Field 3ca which consists of a charge of a core member by approaches, such as wet etching, reactive ion etching (RIE), and die forming, is patternized and formed. There are a spin coat, a spray coat, a curtain coat, the flame depositing method, CVD (Chemical Vapor Deposition), vacuum evaporationo, and the approach of carrying out a spatter about the above-mentioned clad section 3c.

[0037]

[Effect of the Invention] The substrate which has the 1st optical waveguide and electrical circuit of this invention A substrate body, the optical waveguide prepared in this substrate body, and the optoelectric transducer which is prepared in this optical waveguide top or the above-mentioned substrate body, and has a light sensing portion or a light-emitting part in an above-mentioned optical waveguide or substrate body side, It has the reflective member which connects optically the above-mentioned optical waveguide and the above-mentioned optoelectric transducer. The above-mentioned reflective member It is laid under the above-mentioned optical waveguide, and an opposed face with the above-mentioned optical waveguide inclines to the optical axis of optical waveguide, and consists of a massive metal, and it is effective in packaging density and the propagation effectiveness of light improving and having the stable propagation property.

[0038] The substrate which has the 2nd optical waveguide and electrical circuit of this invention In the substrate which has the 1st optical waveguide of the above, and an electrical circuit optical waveguide The lower clad section, It consists of the core section prepared in this lower clad section, and the up clad section prepared in this core section, and a reflective member counters with the above-mentioned core section at least, and is effective in the packaging density and the propagation effectiveness of light of being effective in packaging density and the propagation effectiveness of light improving improving.

[0039] In the substrate which has the 1st or 2nd optical waveguide of the above, and an electrical circuit, it connects with the electric wiring which electric wiring was prepared in optical waveguide and prepared in the optical waveguide top or the substrate body electrically, and the substrate which has the 3rd optical waveguide and electrical circuit of this invention is effective in especially packaging density improving.

[0040] The substrate which has the 4th optical waveguide and electrical circuit of this invention The substrate which has the above 1st thru/or the 3rd one of optical waveguides and electrical circuits is that by which two or more laminatings were carried out. The 1st reflective member which while has the above-mentioned optical waveguide and an electrical circuit, and was prepared in the substrate, The 1st electric wiring which while has the above-mentioned optical waveguide and an electrical circuit in the optical connection with the 2nd reflective member prepared in the substrate of another side which has the above-mentioned optical waveguide and an electrical circuit, and a list, and was prepared in them at the substrate, At least one side of electrical installation with the 2nd electric wiring prepared in the substrate of another side which has the above-mentioned optical waveguide and an electrical circuit is given, and it is effective in the ability to miniaturize especially.

[0041] The manufacture approach of a substrate of having the 1st optical waveguide and electrical circuit of this invention Consist of the lower clad section, the core section prepared in this lower clad section, and the up clad section prepared in this core section, and even if there is little optical waveguide prepared in the substrate body, the above-mentioned core section is countered. It is the manufacture

approach of a substrate of having the above 2nd under which a reflective member is laid thru/or the 4th one of optical waveguides and electrical circuits. It is effective in manufacture being easy by the approach of giving the process which prepares the reflective member which consists of a massive metal equipped with the field which inclines to the optical axis of the above-mentioned optical waveguide on the above-mentioned substrate body, and the process which prepares optical waveguide so that the above-mentioned reflective member may be laid under the list.

[0042] In the manufacture approach of a substrate of having the 1st optical waveguide of the above, and an electrical circuit, before the process which prepares a reflective member in a substrate body, the manufacture approach of a substrate of having the 2nd optical waveguide and electrical circuit of this invention is an approach of giving the process which prepares the lower clad section of optical waveguide beforehand on a substrate body, and the effectiveness that manufacture is easy is.

[Translation done.]

* NOTICES *

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3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is a sectional view explaining optical-electrical circuit substrate of the gestalt of operation of this invention.
[Drawing 2] In optical - electrical circuit substrate of the gestalt of operation of this invention, it is the sectional view showing the field where a reflective member and optical waveguide counter.
[Drawing 3] It is a sectional view explaining the layer which can form electric wiring concerning the gestalt of operation of this invention.
[Drawing 4] It is the sectional view of optical-electrical circuit substrate of the gestalt of operation of this invention.
[Drawing 5] It is the sectional view of optical-electrical circuit substrate of the gestalt of operation of this invention.
[Drawing 6] It is the explanatory view of the manufacture approach of optical-electrical circuit substrate of the gestalt of operation of this invention.
[Drawing 7] It is the approach **** explanatory view concerning the gestalt of operation of this invention which establishes an inclined plane in a reflective member.
[Drawing 8] In the gestalt of operation of this invention, it is the sectional view showing the field where a reflective member and optical waveguide counter.
[Drawing 9] It is the sectional view showing the conventional lightwave signal propagation structure of a system.
[Description of Notations]
1 a substrate body and 2 A reflective member and 3 Optical waveguide and 3a The lower clad section and 4 An optoelectric transducer, and 51-54 Electric wiring, and 101 and 102 optical-electrical circuit substrate and 12 -- the 1st reflective member and 15 The 1st electric wiring and 22 The 2nd reflective member and 25 The 2nd electric wiring.

[Translation done.]

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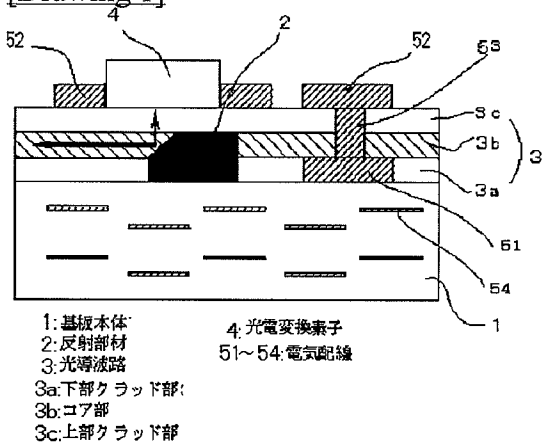
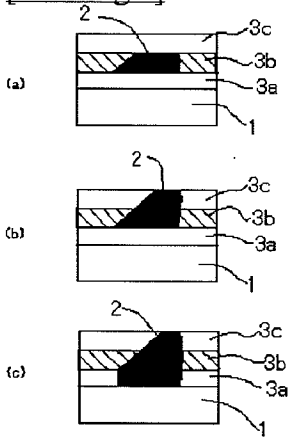
DRAWINGS

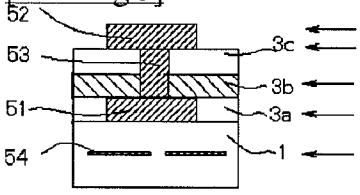
[Drawing 1]



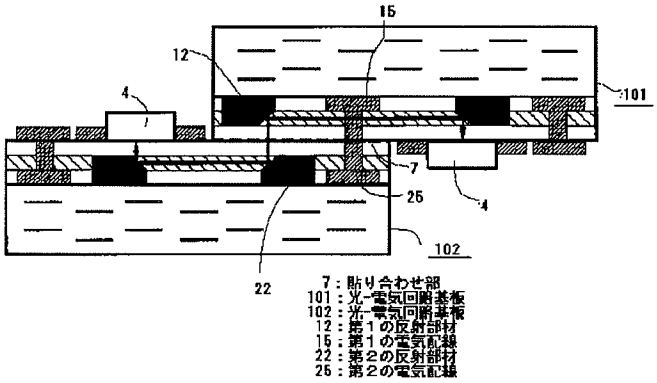
[Drawing 2]



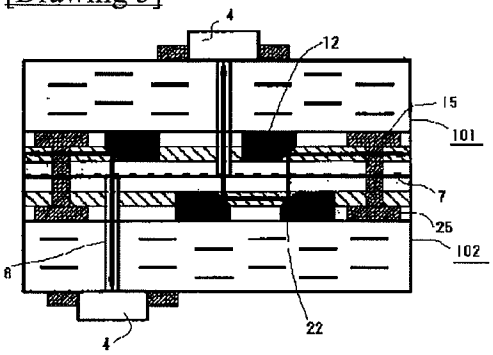
[Drawing 3]



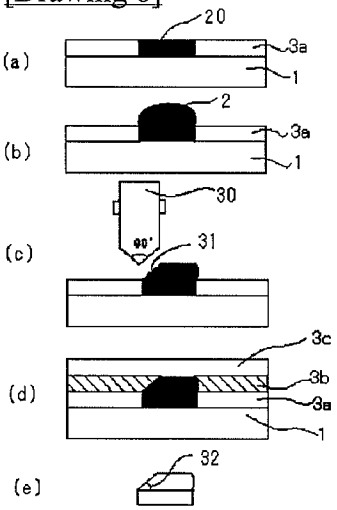
[Drawing 4]



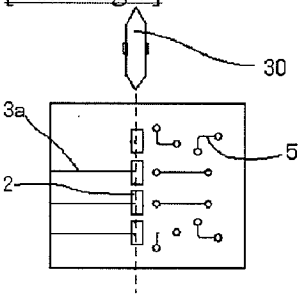
[Drawing 5]



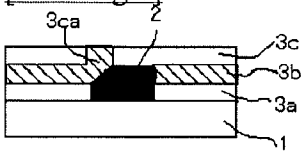
[Drawing 6]



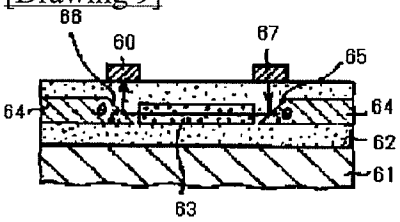
[Drawing 7]



[Drawing 8]



[Drawing 9]



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